10/684,687

PTO: 2005-1826

Japanese Published Unexamined Patent Application (A) No. 02-100833, published April 12, 1990; Application Filing No. 63-251854, filed October 7, 1988; Inventor(s): Keiji Tanabe; Assignee: Tokai T. R. W. Corporation; Japanese Title: Method to Process Rolling Dies

---

METHOD TO PROCESS ROLLING DIES

CLAIM(S)

A method to process rolling dies, wherein an electrode bar for electric discharging process is rolling-processed out of a master rolling dies, and subsequently the rolling dies for use in mass production are electric discharge-processed by using the electrode bar thus rolling-processed.

DETAILED DESCRIPTION OF THE INVENTION

(Field of Industrial Application)

The present invention pertains to a method to process rolling dies for forming screw threads of bolts.

(Prior Art)

High tensile-resistant bolts are extensively used in recent years. Thread forming of a bolt of this type is mostly manufactured by a rolling process, and therefore there is a growing demand for rolling dies necessary for thread forming.

Generally, in the screw thread cutting section of a bolt, stress is gathered by a tensile load exerted on the bolt, so the section tends to be broken.

The degree of the stress gathered in the screw thread cutting section varies depending upon the roundness level of the screw groove bottom. The more round the screw groove bottom is, the smaller the groove coefficient gets, so the gathered stress is dispersed and the strength is improved.

Generally, with a screw rolling dies, the cutting section of a male screw is chamfered to prevent the screw thread of the die end section from being damaged. By this chambering, a sharp angle is formed on the screw thread of the die end section. The rolling dies for a high tensile-resistant bolt provides roundness to the sharp angle. This roundness is not uniform in radius; it is more round at the end section of the screw thread and the roundness is reduced gradually toward the reference screw thread.

(Problem of the Prior Art to Be Addressed)

Therefore, a process of providing the roundness to the screw thread is performed by combined process of manual and mechanical operations. The manual process cannot be omitted, so the time required to process a pair of dies is 6 – 12 hours.

Also, with the manual process, precision is not excellent.

There are primarily three types of shape for rolling dies.

1) flat shape...flat die
2) cylindrical shape...round die
3) arc shape...modified form of round die

The mode of rolling these three types basically the same, as shown by its sectional view in Fig. 5. In Fig. 5, 1 indicates the right die, 2 the left die, and 3 the rolling-manufactured object. However, the section of the die (Fig. 6) to the strength zone 10.9 (The strength zone refers to the zone of mechanical property stipulated in the JIS B-1051- 1985.) is different from the section of (Fig. 7) the high tensile-resistant bolt (12.9 or higher). Fig. 6 and Fig. 7 correspond to section A of Fig. 5.

With the rolling die for high tensile-resistant bolt, all the sharp angles B generated by chambering, shown in Fig. 6, are provided with the roundness by a manual operation using a sand paper or a grindstone while observing through a microscope. By so doing, the roundness γ is made, as shown in Fig. 7. Recently, as a method to reduce this manual operation, there has been proposed an idea wherein a grinding process is applied using an average level of roundness. With this method, however, a manual finishing process is needed to polish the remaining sharp angle.

If the screw threads that contact with a bolt at a time or rolling are not put to the rounding process to make them uniform, precision of a target product (bolt) cannot be accomplished. At present, the operator properly makes the roundness relying on the operator's feel and experience. The irregularity of radius generated by a manual process is 0.1 mm – 0.5 m, and the precision is confirmed by modification process as the rolling-manufacturing is actually conducted.

(Objective)

The present invention aims to present a rolling die processing method that can reduce the number of steps while improving the precision.

(Summary)

The present invention intends to present a method to process a rolling die that is cited in Claim of the present invention.

(Means to Solve the Problems)

1) A master rolling dies 10 and 11 shown Fig. 1 are prepared. These master dies are, for example, the round dies.
2) As shown in Fig. 2, the electrode bars 20 for electrical discharge processing are roll-manufactured by this rolling dies.

3) As shown in Fig. 3, by using the electrode bar 20 thus manufactured by rolling, the rolling dies 200 and 211 for mass production are made by electric discharge process.

If the rolling dies are made by combined process of the prior art manual and mechanical operations, many rolling dies can be made to be used for mass production, and subsequently, many bolts can be mass produced by using these rolling dies.

(Embodiment Example)

As shown in Fig. 1, the right and left master rolling dies 10 and 11 are manufactured. These master rolling dies 10 and 11 are, for example, round dies. The master rolling dies 10 and 11 are manufactured by the prior art method, in other words, a mechanical operation and a manual operation are combined in processing.

As shown in Fig. 2, the electrode bar 20 for electric discharging was rolling-processed by rotating the master dies 10 and 11 thus manufactured, and the precision of the electrode bar was confirmed. For example, by using a copper for the material of the electrode bar 20, 10,000 units of electrode bar 20 with the same level of precision were manufactured by using a pair of rolling dies 10 and 11.

Said electrode bar 20 was mounted on the discharge processing machine 100 equipped with a numerical value control device and rotated. Then, by rotating both members, the electricity is discharged to the material by the numerical value control. Thus, the dies 100 and 200 for mass production were manufactured, as shown in Fig. 4. These rolling-dies 200 and 211 have the roundness necessary for the screw thread at the screw end section (screw cutting section).

This electric discharge process minimizes the electrode's wear and tear, and the surface roughness of the rolling dies after the electric discharge process is 3 μm Rmx, so the required precision for the rolling dies was sufficiently satisfied.

One electrode bar 20 can process 1 – 3 pairs of rolling dies.

The number of electrode bars produced from a pair of master rolling dies and the number of high tensile-resistant bolts produced from the rolling dies for mass production are shown as one example.

A pair of master rolling-dies could produce 10,000 units of same electrode. One unit of electrode bar produced one pair of rolling dies for mass production.

One pair of rolling dies for mass production could process 5,000-30,000 units of high tensile-resistant bolts.

The time it takes for discharge-processing one pair of rolling dies for mass production is 20 – 40 minutes, which shows that the steps of processing can be dramatically reduced relative to the manual processing. In addition, many dies with minimal irregularity, which could not be produced by the prior art method, could be produced.

(Advantage of the Invention)

As explained above, a number of dies with excellent precision and minimal irregularity can be manufactured while dramatically reducing the steps of processing. By use of these rolling dies, the roundness of the screw thread at the screw end section can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a sectional view of the master rolling dies used for embodying the method of the present invention. Fig. 2 shows the way of manufacturing the electrode bar using the master rolling dies. Fig. 3 shows the way of manufacturing the dies for mass production by discharging to the material by use of the electrode bar. Fig. 4 shows a sectional view of the dies for use in mass production. Fig. 5 shows the process of manufacturing a screw by the rolling dies made by the prior art method. Fig. 6 and Fig. 7 show the expanded views of the section A of Fig. 5.

FIG. 1

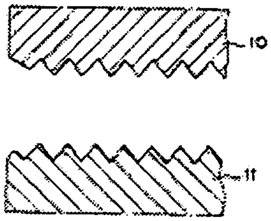


FIG. 2

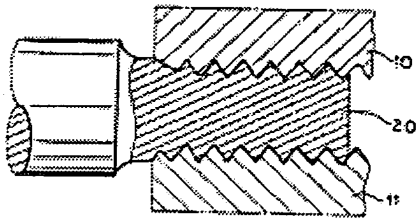


FIG. 3

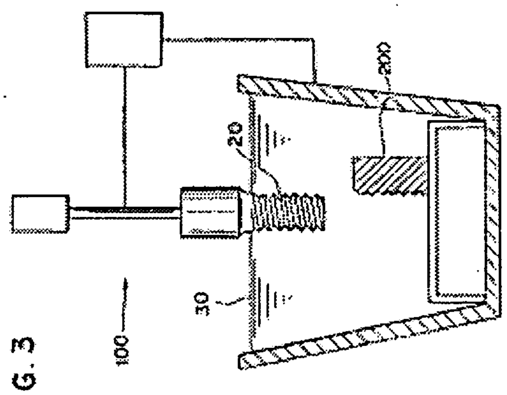


FIG. 4

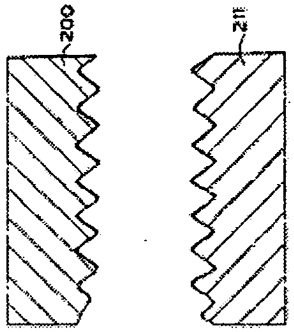


FIG. 5

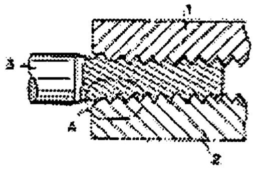


FIG. 6

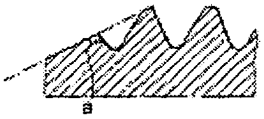
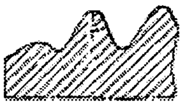


FIG. 7



Translations
U. S. Patent and Trademark Office
1/27/05
Akiko Smith